REMARKS

1. Claims 1-4, 6-8, 10, 13, 14 and 18-37 were last presented for examination. By the foregoing amendments, claims 1, 13, 18, 19 and 27 have been amended. Claims 2 and 31 have been canceled. No claims have been added. Thus, with entry of this paper claims 1, 3-4, 6-8, 10, 13, 14, 18-30 and 32-37 will be pending in this application. Of these 28 claims, four claims (claims 1, 18, 27 and 28) are independent. These amendments do not narrow the scope of the claims as they make explicit that which is implicit in the claims. Further, these amendments are believed not to introduce new matter and their entry is respectfully requested.

Claim Rejections Under 35 U.S.C. §103

2. The Examiner has maintained the rejection of the pending claims under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,760,781 to Kaufman *et al.* (hereinafter "Kaufman"). In the Advisory Action the Examiner incorrectly observes that "Kaufman's slices of data which have been processed by the pipeline system is the [claimed] 2D image," suggesting the inclusion of the feature of the claimed 2D image which distinguishes Applicants' claimed invention.

3. For at least the reasons noted in the prior Response filed on December 9, 2002, Applicants believe no such amendments are necessary and that the claims are patentable in their current form. However, to facilitate prosecution of this application, Applicants have amended independent claims 1, 18 and 27 based on the Examiner's suggestions, making explicit that which is previously implicit in the claims. Specifically, language has been added to these claims to define the two-dimensional (2D) images manipulated by the claimed two-dimensional graphics imaging pipeline as images represented by pixel data comprising color data and X,Y coordinate data, and excluding Z coordinate data. As noted in prior Responses, such two-dimensional graphics imaging pipelines are known in the art and described in Applicants' specification as those imaging pipelines which process such "2D" pixel data. In addition, the separately generated three-dimensional (3D) images composited by the claimed two-dimensional graphics imaging pipeline have been clearly defined to be those images that are represented by pixel data comprising X,Y,Z coordinate and

color data. Finally, the definition of X,Y and X pixel coordinates as commonly used in the art and defined in Applicants' specification were also added to these claims.

4. These amendments clearly distinguish Applicants' invention from Kaufman's volume rendering pipeline. As noted in prior Responses, each type of graphics pipeline (volume rendering pipeline, 2D imaging pipeline and primitive rendering pipeline) has specific structure to perform specific operations on specific types of data. Conventional 2D imaging or pixel pipelines process 2D pixel data; a 3D or geometric pipeline processes primitive data; and a volume or voxel rendering pipeline processes voxel data. In addition to manipulating 2D images like conventional 2D pixel pipelines, Applicants' claimed graphics imaging pipeline composites separately generated three-dimensional (3D) images represented by pixel data comprising X,Y,Z coordinate and color data.

5. Because Kaufman discloses only the above-noted volume rendering pipeline, Kaufman neither discloses, teaches nor suggests Applicants' 2D graphics imaging pipeline as recited in amended claims 1, 18 and 27. For at least these reasons, Applicants respectfully request that the rejection of independent claims 1, 18 and 27 be withdrawn.

6. Independent claim 28 has not been amended while independent claim 31 has been canceled without prejudice or disclaimer. Claim 28 recites:

> 28. A graphics system comprising a two-dimensional imaging pipeline configured to manipulate two-dimensional (2D) images and to composite separately-generated stored three-dimensional (3D) image stored in a frame buffer, and a next 3D image, comprising,
>
> a color data channel adapted to receive Z coordinate data and color data of a next 3D image;
>
> an image compositing module configured to perform a depth test to determine which 3D image is to be rendered at each pixel based on Z coordinate data of the next image received over the color data channel, and Z coordinate data of the stored 3D image, and to store the Z coordinate data of the 3D image to be rendered at that pixel in a depth buffer, and a stencil test to form a stencil mask identifying which 3D image is the image that is to be rendered at each pixel,

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> wherein the imaging pipeline, in response to receipt of color data over the color data channel, updates a color buffer to have stored therein color data of the 3D image to be rendered at each pixel of the composite image.
>
> (*See*, Applicants' claim 28.)

7. As noted in the prior Response, the Examiner has failed to provide any substantive treatment of independent claim 28. Because claim 28 recites features different than those recited in other rejected claims, the Examiner improperly relied on the same basis for rejecting all of Applicants' independent claims. However, Kaufman clearly fails to disclose, teach or suggest a two-dimensional imaging pipeline having a color data channel and image compositing module as recited in claim 28. Accordingly, claim 28 is patentable over the art of record.

8. Because the dependent claims 3, 4, 6-8, 10, 12-14, 19-26 and 29-30 depend directly or indirectly from their respective independent claims and incorporate all of the subject matter thereof, they too are not rendered obvious by Kaufman or any other art of record. Furthermore, these dependent claims add additional subject matter which makes them independently patentable in and of themselves over the art of record. Accordingly, Applicants request reconsideration and withdrawal of the rejection to all dependent claims.

CONCLUSION

9. In view of the foregoing, this application should now be in condition for allowance. A notice to this effect is respectfully requested.

Respectfully submitted
Byron A. Alcorn *et al.*, Applicant(s)

By: _____
Michael G. Verga, Esq.
Registration No. 39,410
Attorney for Applicant(s)

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MARKED-UP VERSION OF CLAIMS SHOWING ALL CHANGES MADE

[ATTACHMENT 1 TO THE SUPPLEMENTAL RESPONSE FILED IN REPLY TO THE OFFICE ACTION DATED DECEMBER 02, 2002 IN U.S. PATENT APPLICATION 09/547,065.]

1. (Amended) A graphics system comprising a two-dimensional graphics imaging pipeline constructed and arranged to manipulate two-dimensional (2D) images represented by pixel data comprising color and X,Y coordinate data, and excluding Z coordinate data, and to composite separately generated three-dimensional (3D) images represented by pixel data comprising X,Y,Z coordinate and color data,

wherein the X,Y coordinate data define horizontal and vertical dimensions of a pixel's display screen location, and wherein the Z coordinate defines an orthogonal distance from the viewpoint to the image rendered at a pixel.

13. (Twice Amended) The graphics system of claim 1, [wherein said 3D images are represented by pixel data comprising Z coordinate data, color data and X,Y coordinate data,] wherein said imaging pipeline receives said Z coordinate data over a data channel of the imaging pipeline configured to transfer data other than Z coordinate data, and receives said X,Y coordinate data over an address data channel.

18. (Twice Amended) A method for compositing 3D images in a 2D imaging pipeline configured to manipulate two-dimensional (2D) images represented by pixel data comprising color and X,Y coordinate data, and excluding Z coordinate data [to form a composited image] comprising:

storing in a frame buffer a stored 3D image including color data and X,Y,Z coordinate data;

processing in the 2D imaging pipeline Z coordinate data of a next 3D image to determine whether the stored or next 3D image is to be rendered at each pixel in a resulting [the] composited image; and

replacing said stored color data with color data of said next 3D image for each pixel at which the next 3D image is to be rendered in the composited image,

wherein the X,Y coordinate data define horizontal and vertical dimensions of a pixel's display screen location, and wherein the Z coordinate defines an orthogonal distance from the viewpoint to the image rendered at a pixel.

19. (Twice Amended) The method of claim 18, wherein said processing Z coordinate data comprises:

transferring Z coordinate data of the next image through an available data channel of imaging pipeline;

depth testing the stored and next images;

updating a depth buffer as necessary to store Z coordinate data of an [a closest] image that is closest to a current viewpoint; and

recording an indication of which 3D image is the closest image.

27. (Amended) A method for compositing a stored and a next three-dimensional image in an imaging/two-dimensional graphics pipeline configured to manipulate two-dimensional images represented by pixel data comprising X,Y coordinate data defining horizontal and vertical dimensions of a pixel's display screen location [address] and color data, and excluding Z coordinate data defining an orthogonal distance from the viewpoint to the image rendered at a pixel, [to form a composited image,] the method comprising the steps of:

1) storing the stored image in a frame buffer of the imaging pipeline, wherein said stored image includes color data and X,Y,Z coordinate data; and

2) processing successively potions of the next image through the imaging pipeline to select which of the next or stored image is closest to a viewpoint and to subsequently save color data of the selected image to the frame buffer.